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# BMW Measurement System

**Model: All**

**Production: All**

# OBJECTIVES

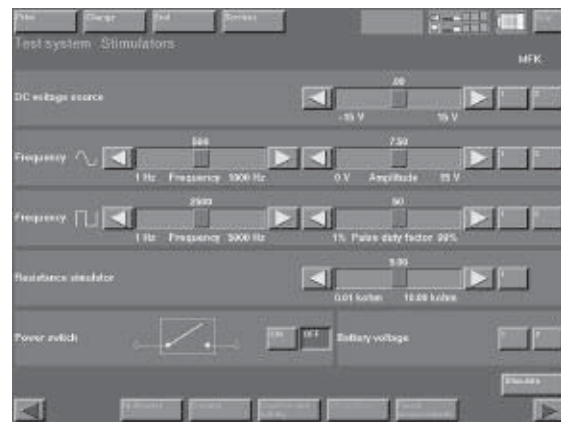
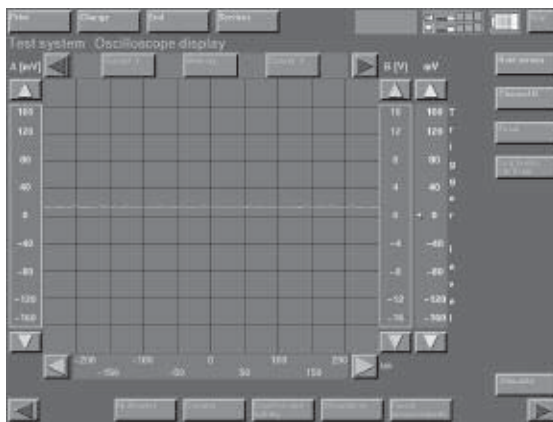
After completion of this module you will be able to:

- Recognize the measurement capabilities under Measurement System.
- Understand the different Measurement System displays and buttons.
- Stimulate an output.

# BMW Measurement System

## Measurement system

Pressing the Measurement system button from the DIS start screen or change menu will call up the Multimeter function.



The following programs are available through the multimeter function buttons along the bottom edge of the screen:

### Multimeter

For measurement of voltage, amperage, resistance, temperature, pressure, and diode testing.

### Counter

For measurement of frequency, period and duty cycle.

### Oscilloscope setting

Digital dual trace scope for measuring wave forms.

### Stimulators

Uses the DISplus multimeter leads as a signal source for DC V AC voltage, pulsed signal generation, resistance, and a power switch.

### Preset measurements

Pre-arranged tests that are used to test the most commonly monitored vehicle signals.

## Multimeter Function

### Multimeter

All of the multimeter functions are displayed in the display area of the screen. Both numerical and bar-graph test results are shown.



## Test Connections

### MFK 1

**Multifunction Cable 1** is used to test all multimeter functions not requiring special sensors. MFK 1 is used to measure:

- Voltage - up to 50 Volts
- Resistance
- Frequency
- Duty Cycle
- Current - up to 2 Amps
- Diode Testing
- Period
- Pulse Duration

### MFK 2

**Multifunction Cable 2**

MFK 2 is used to measure:

- Voltage - up to 500 Volts
- Frequency
- Period
- Duty Cycle
- Pulse Duration

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**Current probe** When selecting the 50 A or 1000A current measurement function, the current probe will be the default test connection. The current probe is self calibrating.

**Pressure sensor** When selecting the pressure measurement function, the pressure sensor will be the default test connection. The reading will begin at approximately 1 Bar (the reading cannot be zeroed).

**Temperature sensor** When selecting the temperature measurement function, the temperature sensor will be the default test connection. The reading is only provided in degrees Celsius.

## Type of Measurement

Various measurements require defining the type of signal measured.



**DC:** Set to test a direct current signal.



**AC:** Set to test for an alternating current signal.

**Effective value** Displays a measured AC wave form as the RMS (root-mean-square) value. The RMS value is the DC equivalent of the voltage or current produced by an AC wave form.

## Measuring Range

Sets scale range for selected measurement.

**automatic** Scale will automatically range to the best suitable range.

**+/- 200mV** Arrows are provided for the user to manually set range of measurement.

## Special Functions

**Hold screen** Freezes the display with the current test results. Serves the same function as the buttons on the large MFK1 and 2 test leads.

**Minimum/Maximum** The current measured value is constantly monitored. The highest and lowest measured value since the activation of the function is displayed below the actual display.

System voltage  
Engine speed

System voltage and engine speed adds an additional field to the display that measures system voltage and engine RPM along with the original measurement. This feature requires that the TD cable and diagnostic head be connected.

2nd  
measurement

2nd measurement splits the main display field into two separate displays. This permits two measurements from separate test leads to be displayed at the same time.

Stimulate

Stimulate allows the user to turn on or off the stimulate output function while in the multimeter. This is useful when applying an output signal to a vehicle circuit for testing purposes.

## Counter

The screenshot shows the Counter function interface with the following annotations:

- Number of pulses per second:** Points to the 'Frequency' button.
- Length of time of one complete cycle in milliseconds:** Points to the 'Period duration' button.
- Length of time the pulse is active (On Segment) in milliseconds:** Points to the 'Pulse duration' button.
- % of time pulse is active during full cycle of wave:** Points to the 'Pulse duty factor' button.
- Freezes the Screen:** Points to the 'Freeze image' button.
- Captures Highest & Lowest Readings:** Points to the 'Minimum/Maximum' button.
- Displays Vehicle Voltage and RPM:** Points to the 'System voltage/Engine speed' button.
- Displays Two Measurements:** Points to the 'M-F.1' and 'M-F.2' buttons.
- Adjusts Sensitivity:** Points to the 'Trigger level' button.
- Activates Stimulation Feature:** Points to the 'Stimulate' button.
- Trailing Edge:** Points to the 'Trailing Edge' button.

Other interface elements include: 'Unit', 'Change', 'Unit', 'Services', 'Freeze image', 'Minimum/Maximum', 'System voltage/Engine speed', 'Measurement function', 'Frequency', 'Period duration', 'Pulse duration', 'Pulse duty factor', 'Test connection', 'M-F.1', 'M-F.2', 'Measuring range', 'Automatic', '0.1 - 1 Hz', 'Trigger level', '5.0 V', 'Trigger edge', 'Leading Edge', 'Trailing Edge', 'Stimulate', 'Auto/Manual', 'Back/Escape/Setting', 'On/Off/Measure', 'Print/Measurement', and 'Range Adjustment'.

The counter function of the DISplus measurement system allows the user to measure time based signals. The measurements are:

- Frequency
- Period
- Pulse duration
- Pulse duty factor

The desired measurement is set-up from the screen by selecting from the following:

- Measurement function
- Test cable
- Measurement range
- Trigger level (default is set at 5 Volts)
- Trigger slope (determines which portion of the signal will be used as the trigger point)

## Oscilloscope Function

The oscilloscope function uses a digital dual trace display screen. There are two methods for setting up the scope to display a pattern: manual setup or preset measurements.

The oscilloscope setting screen is used to manually select how the measured signal will be displayed.

Channel A is displayed in yellow on the screen. Leads available are displayed here.

Channel B is displayed in green on the screen. Leads available are displayed here.

The screenshot shows the 'Oscilloscope setting' screen with the following annotations:

- Channel A measurement type:** Points to the 'Type of measurement' dropdown for Channel A.
- Channel A range:** Points to the 'Measuring range' dropdown for Channel A.
- Frequency range:** Points to the 'Frequency range' dropdown for Channel A.
- Trigger source:** Points to the 'Trigger source' dropdown for Channel A.
- Trigger edge:** Points to the 'Trigger edge' dropdown for Channel A.
- Leading/Trailing Edge:** Points to the 'Leading/Trailing Edge' dropdown for Channel A.
- Channel A measurement type:** Points to the 'Type of measurement' dropdown for Channel B.
- Channel B range:** Points to the 'Measuring range' dropdown for Channel B.
- Writer mode:** Points to the 'Writer mode' button for Channel B.
- Selects trigger source:** Points to the 'Trigger edge' dropdown for Channel B.
- Oscilloscope Display:** Points to the 'Oscilloscope display' button at the bottom.

Once the settings are complete and the test connections are made the oscilloscope graph may be viewed by selecting the “Oscilloscope display” button.

The oscilloscope signal pattern may be adjusted by manipulating the voltage level and the trigger level (voltage) from within the display screen. If the displayed pattern is still unreadable or incorrectly setup, the oscilloscope settings can be further adjusted by returning to the settings screen.

## Oscilloscope Display Screen Features

Once the signal pattern is displayed, the pattern may be locked on the screen with the “Hold screen” button or with the freeze image buttons on the test cable leads.

Holding the image will activate the “Cursor”, “Zoom” and “Memory” features. Holding the image also allows the signal pattern to be visible when printing the screen.

### ■ Cursor 1 and 2

This feature is used to measure the amplitude and time differential of the signal pattern. Activate the feature by pressing the “Cursor 1” button first. A vertical line will appear. Roughly position the line by touching the desired measurement point on the screen.

Anywhere the cursor line intersects the signal pattern, the amplitude value at that point will be displayed in a box on the right of the display screen. If both traces of the scope are being used, (both channel A and B) each value will be shown in its own box. A fine adjustment may be made to the cursor line by using the arrow buttons to the left and right of the cursor buttons.

The time differential between two points may be measured if “Cursor 2” is used. Place the second cursor at the desired measurement point. The time difference value between the two cursors will be displayed in the “Time difference” box on the right side of the screen.

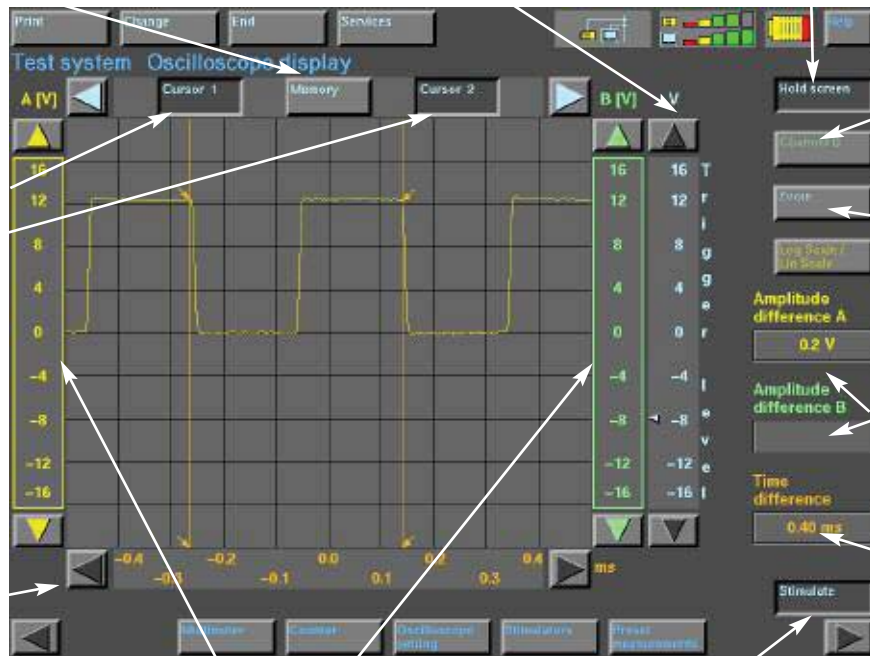
With freeze image selected, press memory. Use the arrow keys to scroll back up to seven screenshots.

Adjust to within voltage level of monitored signal to keep wave from “walking” on the screen.

“Freezes” waveform on screen for measurement display in conjunction with cursor buttons or zoom function.

With freeze image selected, use cursor buttons to mark measuring points on the wave form. Use finger on the pattern to set approximate position and use the arrows to locate exact position.

Time scale of waveform (changes based on scope settings - frequency).



Displays second channel (ex. MFK2)

After pressing freeze, the display can be enlarged (amplitude does not change).

Amplitude values displayed.

Displays time value of marked portion of wave.

Adjusts vertical position of waveform on screen by adjusting baseline position.

Activates stimulation feature.



## ■ Zoom

By selecting the “Zoom” button, a section of the signal pattern may be enlarged to show greater detail. The desired section of the display is called up by touching the screen at the desired spot.

## ■ Memory

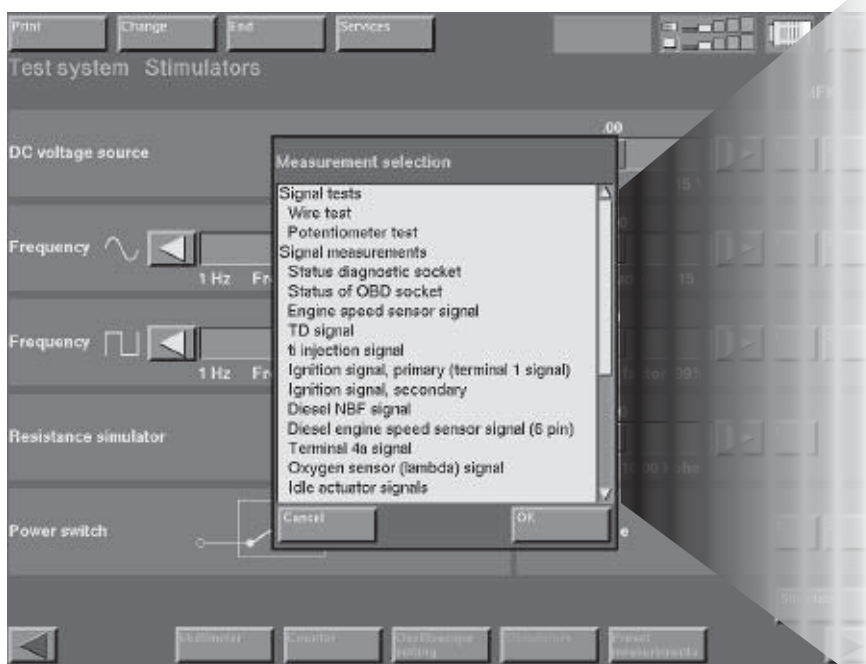
Memory pages are stored every time the Hold Screen is activated. The DISplus stores the last 10 trigger pulses at the time the screen is held. To recall the memory pages, press the “Memory” button and use the left arrow button to scroll through the previous 9 pages (page 10 is already displayed). The cursor and zoom features may be used on the stored pages.

## Preset Measurements

The preset measurements provide an easy method of testing several commonly measured signals. To enter the presets: Press the “Preset measurements” button on the bottom of the screen. A pop up window will provide several signals to choose from. Selecting the signal and pressing the OK button will automatically configure the oscilloscope to the settings needed to provide the best trace pattern. Many tests also have specialized boxes with additional readings( i.e RPM, system voltage).

For instructions on which cables to use for the preset test, follow the instructions in the “Preset measurements” selection of the “Help” menu.

Since the oscilloscope settings are pre-determined, no changes to the oscilloscope are possible.



### Signal Tests

- Wire Tests
- Potentiometer Tests

### Signal Measurements

- Status Diagnostic Socket
- Status of OBD Socket
- Engine speed sensor signal
- TD signal
- ti injection signal
- Ignition signal, primary (terminal 1 signal)
- Ignition signal, secondary
- Diesel NBF signal
- Diesel Engine speed sensor Signal
- Terminal 4a signal
- Oxygen sensor (Lambda) signal
- Idle actuator signals
- Throttle valve potentiometer signal
- Camshaft sensor signal

### Further measurements

- Alternator test
- Absolute compression
- Relative compression
- Pressure distribution
- Smooth running
- Xenon Headlight test up to 8/98
- Xenon Headlight test from 9/98

## Output Stimulator

The stimulation function of the multimeter can be used to provide an output signal from the DISplus to test various components or vehicle wiring. MFK 1 and the small leads of MFK 2 are used to conduct the output signal. After selecting the cable, press the Stimulate button in the right lower corner to activate.

The following signal types may be simulated with this function:

- DC Voltage from 0 to 15 Volts
- AC Voltage from 1Hz to 1KHz and 0 to 15 Volts
- Digital frequency from 1Hz to 5KHZ and 0 to 100% duty cycle
- Resistance from 0 to 10Kohm (MFK 1 only)
- DC voltage using on/off switch

